

1 **Title:** The global conservation movement is diverse but not divided

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The global conservation movement is diverse but not divided

Abstract

Biodiversity is being lost at an unprecedented rate, making the conservation movement of critical importance for life on Earth. However, recent debates over the future of conservation have been polarised, acrimonious and dominated by an unrepresentative demographic group. The views of the wider global conservation community on fundamental questions regarding what, why and how to conserve are unknown. Here we characterise the views of 9,264 conservationists from 149 countries, identifying specific areas of consensus and disagreement, and three independent dimensions of conservation thinking. The first two dimensions (‘people-centred conservation’ and ‘science-led ecocentrism’) have widespread support, whereas ‘conservation through capitalism’ is more contentious. While conservationists’ views on these three dimensions do not fall into distinct clusters, there are clear relationships between dimension scores and respondents’ gender, age, educational background, career stage and continent of nationality. Future debates and policy processes should focus on the most contentious issues, and do more to include the perspectives of under-represented groups in conservation who may not share the views of those in more powerful positions.

Main

Conservation is at a crossroads. Biodiversity loss is widely recognised as having serious consequences, but despite decades of effort in policy and site specific interventions, extinction rates remain high^{1,2}. The Convention on Biological Diversity 2010 goal to achieve “a significant reduction of the current rate of biodiversity loss” was not achieved, and there is no indication that the CBD Aichi targets for 2020 will be met³. Against this backdrop,

negotiations are underway for the post 2020 Biodiversity Framework of the CBD, which will set the global conservation agenda for at least a decade to come. There is widespread agreement that conservation needs to be more bold and ambitious, and to find more effective implementation measures^{4,5}. However, setting the future direction of conservation is hampered by the existence of various competing proposals which diverge on fundamental questions about why, what and how to conserve^{4,6–9}. Two positions in particular have been prominent in recent debates. Proponents of ‘new conservation’ argue for protecting biodiversity because of its importance to people, and emphasise partnerships with corporations, the natural capital approach, and the use of market-based tools such as payments for ecosystem services^{6,10,11}. Meanwhile advocates of ‘traditional conservation’ reject these views, arguing instead for the protection of nature for its own sake and emphasising state-based protected areas and regulation^{7,12,13}. This latter position is associated with calls for the radical expansion of protected area coverage targets in the post 2020 CBD framework to at least 50% of the terrestrial and marine realms^{5,8,9}.

The ‘new conservation’ debate has dominated conservation thinking for several years, creating the impression of a stark choice to be made about the future of conservation. However, the debate has been critiqued in various ways. First, for recasting as ‘new’ what are in fact long-standing disagreements in conservation^{11,14,15} over underlying rationales (such as ecocentrism and anthropocentrism)^{16,17}, the role of market based approaches and economic valuation^{18,19}, and the relationship between conservation and development^{14,20}. Second, for falsely suggesting there are only two perspectives, leaving out important alternative views on conservation, such as a ‘critical social science’ view which favours conservation for the benefit of people but disagrees with the use of market based approaches^{4,21,22}. Third, for under-representing the diversity of voices in the wider conservation community, because the main protagonists of the ‘new conservation’ debate are from an unrepresentative

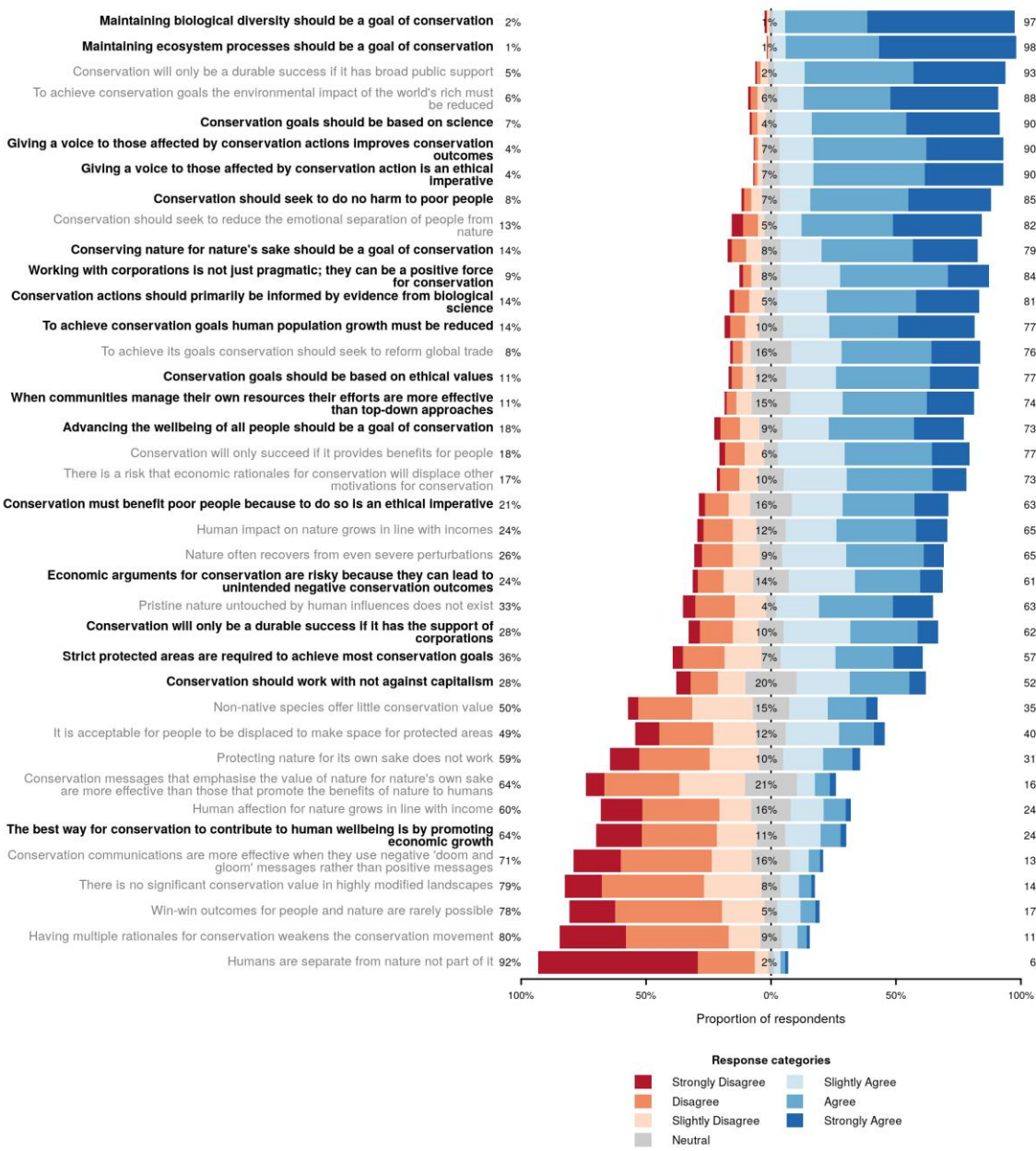
demographic group of North Americans who hold senior positions²³. Fourth, for being conducted in an excessively acrimonious and hostile tone^{24,25}.

Addressing these critiques and moving the debate forwards requires empirical evidence on the views of the wider conservation community. However, at present these views remain unknown, beyond studies of specific issues such as coexistence with carnivores²⁶. Here, we report the findings of an online survey of 9,264 conservation practitioners and academics from 149 countries (Supplementary Figure 1). This is the largest published survey of the professional conservation community, responding directly to calls for conservationists to carefully identify their views and values, and to express them explicitly^{14,27}. Respondents indicated their level of agreement with 38 Likert items that were designed to assess their views on the issues raised within the new conservation debate, such as the underlying rationales for conservation, how goals should be set and the appropriateness of various tools to achieve those goals (Figure 1; see Methods for details). Respondents also provided information on their gender, age, educational background, career stage and continent of nationality (Supplementary Table 1). The survey was distributed via relevant listservs and through social media channels, targeted to encompass a range of ages and seniority (e.g. postgraduate and early career lists), disciplines (e.g. conservation social science, ecology specialist lists) and geographical locations (continent and country specific lists). The survey was then circulated organically amongst networks of conservation professionals and through social media such as Twitter and Facebook.

Areas of consensus and polarization

We found high levels of consensus among our respondents on multiple survey items, but also important areas with high levels of polarization (Figure 1; Supplementary Figure 2). As might be expected, the strongest consensus was in agreement that the maintenance of biodiversity

95 and ecosystem processes should be goals of conservation. There was also strong consensus in
96 agreement that humans are part of nature, not separate from it. This is perhaps surprising as
97 nature is often spoken of by some conservationists as if it were distinct from people, for
98 example, in the ‘nature needs half’ slogan²⁸. The most polarising issues each have a long
99 history of intensive debate within the conservation community. These included the
100 acceptability of displacing people to establish protected areas²⁹, the need for strict protected
101 areas to achieve conservation goals³⁰ and the question of whether pristine nature untouched
102 by humans exists³¹.



105 -----Figure 1 to go approximately here. The legend is at the end of the manuscript -----

107 **Dimensions of the conservation debate**

108 To examine whether the observed patterns of responses to our Likert items were linked to a

109 smaller number of underlying dimensions of thinking, we carried out an exploratory item

factor analysis on our data. Having determined the appropriate number of dimensions to extract (see Methods) we fitted a multidimensional graded response model³² which correctly accounts for the ordinal nature of the responses. We then rotated the raw factor loadings to produce more interpretable results, using an oblimin rotation which allows for the possibility that the factors might be correlated. As a check on the robustness of our findings, we repeated this procedure on two randomly selected subsets of the data, each comprising one third of our total responses (Supplementary Figure 4).

Based on these analyses, we identified three latent variables which were theoretically coherent and consistent across the two replicates. Each variable represents a different dimension of conservation thinking, which together characterise views on important aspects of the aims and practice of conservation (Table 1). Dimension 1 (‘people-centred conservation’) relates to the role of people in conservation, as participants and stakeholders. Dimension 2 (‘science-led ecocentrism’) relates to the role of science in the conservation of species and ecosystems, consistent with fundamental elements of ecocentric thinking^{33,34}. Dimension 3 (‘conservation through capitalism’) relates to the role of corporations, economic metaphors and market based approaches in conservation (Table 1).

Factor	Item	Text	Loading
F1	30	Giving a voice to those affected by conservation action is an ethical imperative	0.736
	4	Conservation must benefit poor people because to do so is an ethical imperative	0.686
	29	Conservation should seek to do no harm to poor people	0.661
	24	Giving a voice to those affected by conservation actions improves conservation outcomes	0.634
	18	Advancing the wellbeing of all people should be a goal of conservation	0.627
	20	Conservation goals should be based on ethical values	0.449
	32	When communities manage their own resources their efforts are more effective than top-down approaches	0.400
F2	6	Conservation actions should primarily be informed by evidence from biological science	0.635

	10	Conservation goals should be based on science	0.633
	37	Maintaining biological diversity should be a goal of conservation	0.600
	3	Conserving nature for nature's sake should be a goal of conservation	0.457
	21	Maintaining ecosystem processes should be a goal of conservation	0.454
	16	To achieve conservation goals human population growth must be reduced	0.423
	9	Strict protected areas are required to achieve most conservation goals	0.405
F3	15	Working with corporations is not just pragmatic; they can be a positive force for conservation	0.734
	14	Conservation should work with not against capitalism	0.733
	28	Conservation will only be a durable success if it has the support of corporations	0.587
	31	The best way for conservation to contribute to human wellbeing is by promoting economic growth	0.504
	22	Economic arguments for conservation are risky because they can lead to unintended negative conservation outcomes	-0.418

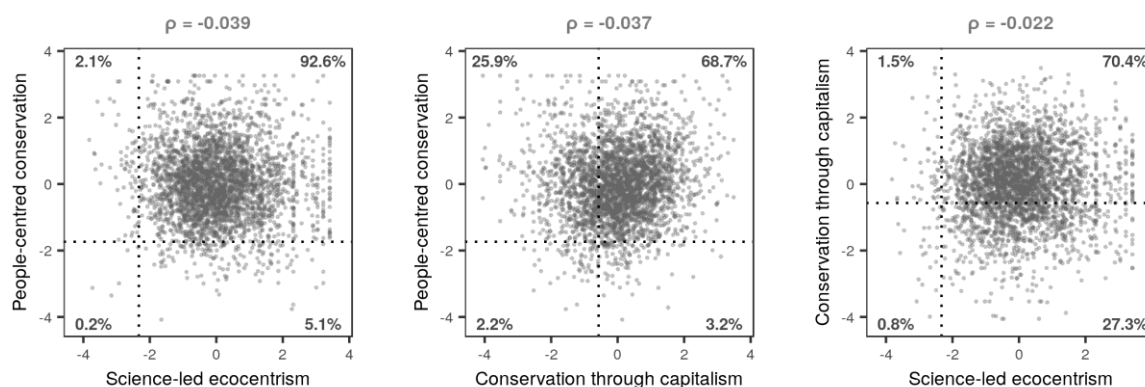
Table 1: Factor loadings from a confirmatory three dimensional item factor analysis.

Dimension F1 is labelled as “People-centred conservation”, F2 as “Science-led ecocentrism”, and F3 as “Conservation through capitalism”. Within each dimension, items are presented in order from most strongly positive loading to most strongly negative loading.

All three dimensions reflect longstanding debates in conservation, although the third has become particularly contentious in recent years²¹. The three dimensions can be used to describe a wide range of conservation viewpoints. For example, based on its description in the literature^{6,7}, the ‘new conservation’ position is people-centred, in favour of conservation through capitalism but generally critical of ‘science-led ecocentrism’, whereas the ‘traditional conservation’ position is the converse. If most respondents adhered to the ‘new’ or ‘traditional’ positions, we would expect them to cluster into two groups corresponding to these positions, where the positions of respondents on each dimension would be highly correlated within each cluster. In fact, we found that factor scores calculated from a

confirmatory model fitted to a third, independent subset of the responses were not substantially correlated and respondents exhibited a wide range of positions on all three dimensions, with cluster analysis revealing no evidence of distinct sub-clusters (Figure 2; Supplementary Figures 5 and 6).

To understand better the underlying views of respondents on the Likert items associated with each dimension, we plotted their positions on each dimension relative to the point that would result from a neutral answer to all Likert items (Figure 2). This showed that the great majority of respondents were in favour of both ‘people-centred conservation’ and ‘science-led ecocentrism’, to a greater or lesser extent, despite the fact that these perspectives are often treated as mutually exclusive^{35–37}. This might reflect a pragmatic recognition that different approaches are suitable for different contexts, combining to a more heterogeneous overall strategy. Opinions over conservation through capitalism’ were more polarised, with 28.1% of respondents against this approach, contrasting with only 5.4% opposing ‘people-centred conservation’ and 2.3% opposing ‘science-led ecocentrism’ (Figure 2). This relatively high level of concern about ‘conservation through capitalism’ is important given the prominent role of market-based approaches and corporate partnerships in contemporary conservation practice³⁸.



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Conservationists' characteristics predict their views

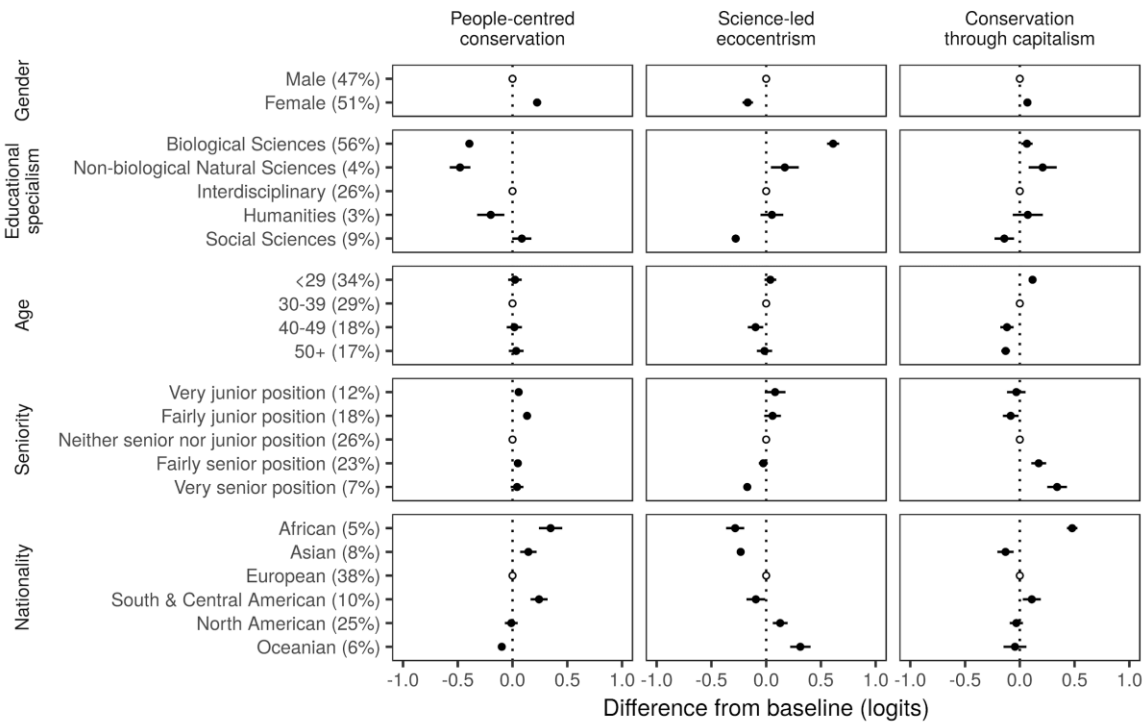
To find out whether respondents' estimated positions on each dimension were related to demographic variables, we constructed explanatory models (Figure 3). Demographic results for 'people-centred conservation' showed that women, those with non-natural science training and people from Africa, Asia and South and Central America were more in favour of this approach (Figure 3). The gender result could be linked to the on-average higher levels of empathy for the wellbeing of other humans among women than men³⁹. The disciplinary result is likely due to social science and interdisciplinary training emphasising the role and importance of people¹⁴, although the direction of causality is not clear. The variation between regions of the world could be linked to geographical variation in the extent to which conservation actions impact the lives of local residents, or in worldviews on the relationship between people and their environments⁴⁰. It is striking that within our sample the regions with stronger support for people-centred conservation contain the great majority of developing countries.

Results for ‘science-led ecocentrism’ showed that women were less in favour of this approach than men, suggesting a gender dimension to these ideas that merits further research. Biological scientists strongly support ‘science-led ecocentrism’ and social scientists strongly oppose it, with other disciplines in the middle. This is not surprising given the strongly contrasting disciplinary perspectives within biology and social science on the statements comprising this dimension. Very senior conservationists were less in favour of this approach than more junior colleagues, perhaps suggesting that those holding these views are less likely to become senior, or that these ideas lose their appeal as one gains professional experience. Finally, support for ‘science-led ecocentrism’ was strongly linked to region of origin, with those from North America and Oceania tending to favour this approach most strongly, in direct contrast to results for people-centred conservation. This could be due to the strong history of ideas relating to wilderness and strict protected area-based conservation in these regions⁴¹.

Conservation through capitalism was favoured by women, those without social-science training, younger respondents, more senior respondents, and those from Africa. The gender effect merits further investigation. The academic background effect may be caused by the dominance of social science disciplines in research critical of links between conservation and capitalism³⁸, which influences teaching. The age effect perhaps reflects the emergence of a younger generation of conservationists for whom close links to capitalism have existed since before they entered the sector. The seniority effect raises interesting questions about causality, such as whether conservationists become senior because they already hold certain views, or develop them having moved into a senior position, perhaps as a pragmatic response to the funding landscape or prevailing societal views^{42,43}. Finally, the regional result, which is consistent with earlier research¹¹, is likely due to the importance of sport-hunting and

photographic tourism as a funding model for conservation in various countries of Eastern and Southern Africa⁴⁴, the regions from which most of our African respondents originated.

We found strong relationships between all the demographic variables we investigated and at least one of the three dimensions of the conservation debate. Indeed gender, disciplinary training and continent of nationality were strongly linked to all three dimensions. Further research could investigate these links in more detail. These results support claims that the lack of diversity of participants in recent public debates about the future of conservation has led to an under-representation of certain viewpoints held within the wider conservation community²³. Given power imbalances between different demographic groups, this also raises questions about whether ideas unpopular with some conservationists are being imposed on them by more powerful supporters of those ideas, as has occurred in the past⁴⁵. For example, respondents from Africa, Asia and South & Central America (where most biodiversity is located) tended to be more in favour of people-centred conservation and less in favour of science-led ecocentrism than respondents from Europe, North America and Oceania. Conservation in the former group of continents has, in many cases, been strongly influenced by individuals and organisations from the latter group of continents⁴¹.



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223 **Sample and survey limitations**

224 While our sample is the largest and most diverse of any study of the global conservation
225 community, it is important to note that the sampling strategy was based on opportunistic
226 sharing of an online survey and is therefore not representative of the full conservation
227 community (although in the absence of data characterising global conservationists, it is
228 impossible to design a truly representative sampling strategy). For example, our sample over-
229 represents highly educated conservationists from English speaking and wealthy countries,
230 and under-represents those from non-English linguistic or less internationalised conservation
231 backgrounds (e.g. indigenous perspectives). For this reason we caution against over-
232 interpreting our results, particularly for less well represented demographic groups. These
233 imbalances in our sample matter, because (i) those over-represented have tended to dominate

conservation debates, (ii) there are differences in the opinions held by conservationists from wealthier and less wealthy regions, and (iii) most biodiversity is located in less wealthy countries⁴⁶.

A second limitation relates to the design of the survey itself. The Likert items were developed through a rigorous process (see Methods), and were deliberately focused on the issues at stake in the new conservation debate over recent years. While this debate incorporates elements of many long-standing debates in conservation, it does not capture the full range of possible issues pertinent to the future of conservation, including, for instance, those existing in languages other than English, or in indigenous worldviews. The survey results should not, therefore, be interpreted as based on an exhaustive review of all possible conservation futures. In addition, the Likert items were presented free of context, making it difficult for some respondents to judge their level of agreement, particularly where they felt they would agree in some circumstances and disagree in others. This last point may also help to explain why most respondents agreed with both people-centred conservation and science-led ecocentrism: in many contexts, conservation interventions have to consider trade-offs between maximising biodiversity and human development²⁷, but the survey did not force respondents to reveal a position on such trade-offs. The limitations of this study create interesting openings for further research into broader ideas about the future of conservation and how perspectives vary with context.

Conclusion

At a time when the conservation movement is facing bitter internal disputes over its future, our results demonstrate empirically that at the aggregate, global scale, it is less divided than

some have claimed^{7,47}. The great majority of conservationists agree with each other on many important questions and their views do not fall into discrete clusters based on their positions on three key dimensions of debate. However, when disaggregating our results by demographic variables, important differences between social groups emerge. These are not sufficient to be considered distinct clusters or camps (Supplementary Figures 5 and 6), but they reinforce the importance of recognising dimensions of social difference in conservation, and how these factors influence views.

Our results have important implications for conservation. Shared views on key issues provide the bedrock for any social movement, and the identification of the specific areas where consensus exists within the conservation movement should provide the basis for productive and less hostile engagement. The finding that there are no distinct ‘camps’ within the conservation community also lends credibility to calls for a more inclusive and unified conservation movement^{23,25,48}. Nonetheless, even moderate differences in the extent to which people agree with certain ideas may result in fundamentally different priorities for conservation practice, particularly where trade-offs need to be made. In addition, our results identify several contentious issues that polarize the conservation community, including protected area management and the appropriate relationship between conservation, corporations and capitalism. In some cases addressing a diversity of conservation challenges may be well served by the existence of diverse conservation ideas and strategies^{25,49}. However, where differences are irreconcilable this should be made explicit and deliberated rather than suppressed in the name of inclusivity^{22,26}.

The demographic results identify consistent differences in average viewpoints by gender, educational background, age group, seniority and continent. Given historical links between all of these dimensions of social difference and uneven power relations, these findings raise important questions about whose voices get heard in conservation debates, and who is able to

283 influence conservation action. Conservation is a diverse movement, both in people and ideas,
284 and our results support calls for initiatives to ensure improved representation of social
285 diversity in ongoing debates over the future of conservation⁵⁰.

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289 **Methods**

290 **Survey design and sampling**

291 Likert items that form the basis of the Future of Conservation survey were used in a previous
292 Q methodological study, which describes the process by which they were derived²¹. Within Q
293 methodology, statements are selected to represent the greatest possible coverage of views that
294 exist among the respondent community on an established debate/topic⁵¹, in this case,
295 published contributions to the ‘new conservation’ debate. Some of the statements resemble
296 what social psychologists have termed ‘attitudes’, which are specific and contextualised
297 views on particular issues; an example of this is the item ‘It is acceptable for people to be
298 displaced to make space for protected areas’. In contrast, other statements represent more
299 fundamental, cross-situational values⁵²; for instance, ‘Conserving nature for nature’s sake
300 should be a goal of conservation’. Based on the experience of our earlier research²¹, and
301 further piloting of the statements to test their practicality as Likert items with an additional 14
302 participants, we made minor adjustments to four items to improve clarity. One further item
303 was also entirely replaced by a new one. The item “plural rationales for conservation weaken
304 the conservation movement”, was replaced with “having multiple rationales for conservation
305 weakens the conservation movement”. The item “nature often rebounds from even severe
306 perturbations” was replaced with “nature often recovers from even severe perturbations”. The
307 item “conservation communications are more effective when they use doom and gloom rather
308 than positive messages”, was replaced with “conservation communications are more effective
309 when they use negative 'doom and gloom' messages rather than positive messages”. The item
310 “conservation messages promoting the benefits of nature to humans are less effective than
311 those that emphasise the value of nature for nature's sake”, was replaced with “conservation
312 messages that emphasise the value of nature for nature's own sake are more effective than
313 those that promote the benefits of nature to humans”. We added one item “When

communities manage their own resources, their efforts are more effective than top-down approaches” as we identified this as an element of the new conservation debate that was not included in the original set of statements. We removed one item: “There is a risk that highlighting human domination of the planet may be used to justify further environmental damage” because this was not interpreted consistently by respondents in our previous work²¹. This gave a total of 38 statements as Likert items in the Future of Conservation survey (see Figure 1). The finalised statements in the web survey format were then piloted with 55 respondents known to the authors, with feedback sought on the clarity of statements, the medium and usability. No substantial changes were made to the survey after this.

Online survey design and distribution

We developed a bespoke web-based survey built by the Informatics Team at the UN Environment World Conservation Monitoring Centre and hosted at URL: www.futureconservation.org. This incorporated the 38 Likert items, with a corresponding 7-option Likert framework (strongly agree/disagree; agree/disagree; slightly agree/disagree; neutral). We also collected demographic information about respondents. This included information about: gender; age; level of education and educational specialism; professional experience in research/practice; career seniority; nationality; geographical location of work as a conservationist; professional experience beyond the conservation sector; extent of human modification of landscapes where professional experience took place; experience of market-based schemes in conservation; experiences that were perceived to shape conservation values. These demographic questions were tested using the pilot processes described above.

The survey was launched and first publicised in March 2017, using the distribution strategy described in the main text. The survey website remains open, but the last date of a response included in this study is 29th May 2018.

Data preparation

Data preparation and analysis was carried out in R version 3.5.0⁵³. Our initial data set contained 11,272 responses. Prior to analysis, we first removed responses that identified the respondent as having previously taken the survey. This included those that had been submitted from the same IP address and had either given identical responses to the thirty-eight Likert items or gave the same email address. We also removed responses where there were missing data for any of the Likert items or demographic questions, or where the same response was given to all of the Likert items (e.g. all "Strongly agree"). Finally, we excluded responses from those who answered "Not applicable" to the question "In which of the following sectors have you done conservation work in your career?", indicating that they have no direct experience of working or conducting research in conservation, and respondents who reported themselves to be younger than 18. In total, we excluded 2,008 responses based on these criteria, leaving 9,264 responses for analysis.

Information about the respondents' personal characteristics used in this study was coded as a series of categorical variables: gender (male / female / other or prefer not to say); educational specialism (biological sciences / non-biological natural sciences / interdisciplinary / humanities / social sciences); age (<29 / 30-39 / 40-49 / 50+); seniority (very junior position / fairly junior position / neither senior nor junior position / fairly senior position / very senior position); and continent of nationality (Africa / Asia / Europe / South & Central America; North America; Oceania).

Investigating polarization in the survey data

To examine the extent to which there was broad consensus of opinion amongst our respondents we calculated polarization scores based on the responses to each statement. Polarization is a statistic that ranges from 0 to 1, where a score of 0 corresponds to all

respondents giving the same answer and a score of 1 corresponds to half of the responses falling in one category, and half falling in a second, non-adjacent category. A score of 0.5 corresponds to a situation where responses are uniformly distributed across all of the available response categories. 95% confidence intervals around the polarization score were calculated from a non-parametric bootstrap with 200 independent draws for each Likert item.

The level of polarization in the responses to each Likert item within our survey ranged from moderate - 0.418 (95%CI: 0.413, 0.427) for “It is acceptable for people to be displaced to make space for protected areas” - to very low polarization - 0.093 (95%CI: 0.090, 0.097) for “Maintaining biological diversity should be a goal of conservation” (Supplementary Figure 2).

Modelling strategy

Our analyses were carried out within the framework of multidimensional item response theory⁵⁴ and focused on understanding the number and content of latent dimensions capable of explaining patterns of variation in responses to the survey's Likert items, quantifying the level of these latent traits in individual respondents and understanding whether and how these latent traits might be related to respondents' individual characteristics. Our modelling strategy involved three distinct phases: an exploratory phase in which we examined the structure and dimensionality of the data, a confirmatory phase in which we formally tested the adequacy of the structure we arrived at and an explanatory phase in which we modelled latent trait values as a function of individual demographic characteristics⁵⁵. To allow this, we split the data into three randomly-sampled, equally-sized subsets, each containing 3,088 responses. The first two subsets were used during the exploratory phase, running identical exploratory analyses in parallel and comparing their results to assess the robustness and stability of the solution⁵⁶. The third subset was then used for the confirmatory phase to minimise the problems

associated with performing both exploratory and confirmatory analyses on the same data⁵⁴.

Having arrived at a satisfactory model structure, the three subsets were recombined in the

final, explanatory phase to provide the greatest precision for our estimates of the effects of

individual characteristics.

Exploratory modelling

To evaluate the dimensionality of the data, we calculated Velicer's Minimum Average

Partial (MAP) criterion⁵⁷ and examined scree plots based on the matrices of polychoric

correlations calculated for each of the first two subsets of the data (Supplementary Figure 3).

These criteria suggested that up to five distinct factors might be present in the data so we

carried out an item factor analysis based on the multidimensional graded response model³²,

comparing solutions for three, four and five dimensional models. All models were fitted

using the mirt function from the mirt package version 1.28⁵⁸, with parameters estimated via

the Metropolis-Hastings Robbins-Monro algorithm⁵⁹. To improve interpretation the initially-

extracted factor loading matrix was extracted using oblimin rotation. Since we had no prior

theoretical expectation about the correlation of the latent dimensions, an oblique rotation was

chosen to allow the factors to be correlated with each other to the extent that was supported

by the data. Our choice between the alternative models was guided by the theoretical

coherence of the resulting factors, the loading patterns of the items onto each pattern (e.g.

three or more items loading $>|0.40|$ and either two or more items loading $>|0.50|$ at least one

item loading $>|0.60|$ onto each factor, and few strongly cross-loading items between

factors)⁶⁰, and the consistency of the solution arrived at for each of the two subsets of the data

(Supplementary Figure 4). Having identified items that did not load sufficiently strongly onto

any factor or loaded strongly across multiple factors, we excluded them from the dataset and

refitted the model as a further check for consistency.

Confirmatory modelling

Next, we fitted a confirmatory multidimensional graded response models to the third subset of our data, whose dimensionality and structure was informed by the outcomes of our exploratory modelling. Since not all of the initial set of Likert items were well captured by these dimensions, only items which were identified as loading substantially ($>|0.4|$) on one factor and having no strong cross-loading onto other factors (no other loadings $>|0.3|$ and a difference of at least 0.2 between the loading on the main factors and strongest loading on any other factor) were retained in order to obtain simple structure. The model was fitted using the mirt function from the mirt package by supplying a user-specified structure including an unstructured covariance matrix⁵⁸.

Assessing the goodness-of-fit of models is challenging for large datasets with complex, polytomous responses, where the full table of possible response combinations may be very sparse⁶¹. We therefore complemented assessments of the fit of the model via a χ^2 statistic calculated based on the expected a posteriori summed-scores⁶² and M_2^* , a limited-information statistic⁶³, the Confirmatory Fit Index and the Tucker-Lewis index⁶⁴, with assessments of the adequacy of the approximation provided by the model based on the root mean squared error of approximation (RMSEA) and standardized root mean squared residuals (SRMSR)⁶⁴. We also assessed possible violations of the assumption of local independence using the local dependence matrix calculated from the χ^2 statistic and standardized residuals calculated from M_2^* for every pair of items⁶⁵.

Once a satisfactory fit was obtained, the model was used to estimate the maximum likelihood values for the set of latent trait scores for each respondent represented in the data⁶⁶. In order to provide an intuitive point of comparison, we also calculated the latent trait score that would be expected if a hypothetical respondent had answered "Neutral" to all of the value

statement items within the survey. This allowed us to judge the extent to which respondents within our sample were broadly supportive or opposed to the ideas represented by each of the modelled dimensions.

Explanatory modelling

In the final phase of our modelling, we tested for (a) the presence of clustering within the views of our respondents and (b) evidence of consistent differences in views linked to respondents' personal characteristics.

To test for clustering within the views of our respondents we fitted a series of Gaussian finite mixture models⁶⁷ to the estimated latent trait scores for each person represented within our data using the mclustICL function from the R package, mclust⁶⁸. We had no a priori expectation about the number or shape of clusters that might be present in the data so we fitted a candidate set of 126 models in total, representing all possible combinations of the number of mixture components (up to nine) and the geometric characteristics of the clusters (14 cluster types: spherical, equal volume; spherical, unequal volume; diagonal, equal volume and shape; diagonal, varying volume, equal shape; diagonal, equal volume, varying shape; diagonal, varying volume and shape; ellipsoidal, equal volume, shape, and orientation; ellipsoidal, equal volume and orientation; ellipsoidal, equal shape and orientation; ellipsoidal, equal orientation; ellipsoidal, equal volume and equal shape; ellipsoidal, equal shape; ellipsoidal, equal volume; ellipsoidal, varying volume, shape, and orientation). The fit of these models was compared using the integrated-complete data likelihood criterion (ICL), an information criterion that has been demonstrated to perform well in identifying the correct number of clusters, with the best-fitting model taken to be the one highest ICL value⁶⁹.

To test for differences in views linked to respondent characteristics we constructed a person-explanatory version of the graded-response model⁵⁵ by incorporating five variables

representing characteristics of our respondents - gender, age, professional seniority, continent of nationality and educational specialism - as fixed effects in a latent regression. The coefficients for these fixed effects, and their associated standard errors, were inspected to explore whether predictable, systematic differences exist in the positions of respondents along each latent dimension, linked to their personal characteristics.

Data availability

The datasets generated and/or analysed during the current study are not publicly available, to maintain respondent anonymity which was a condition of the ethical approval of the study (University of Leeds Research Ethics Committee reference LTSEE-054). All data gathered are stored securely and anonymously by UN Environment World Conservation Monitoring Centre. Please see <http://futureconservation.org/about-the-project> for full details of the Future of Conservation project's ethics and data security protocols.

Project Ethics

The project has a 'project ethics' entry on the following page (<http://futureconservation.org/about-the-project?locale=en>), which is duplicated below:

"This project has been approved by the Research Ethics committee at the University of Leeds.

All data gathered will be stored securely and anonymously by UN Environment World Conservation Monitoring Centre, and used solely for the purposes of this research project. It will not be seen by anyone outside the research project.

Your individual responses will not be identifiable either in this website or in subsequent publications. If you provide us with your email address, we will not share it with other

parties, and will only use this to send you summarised results and to invite you to participate in the survey again in future.”

Supplementary Information is linked to the online version of the paper at www.nature.com/nature

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Author contributions

C.S., J.F and G.H. conceived the project and designed the survey. C.S., J.F., G.H. and R.L. wrote text for the survey website and promoted its uptake. A.K. analysed the data. All authors wrote the manuscript.

Competing interests

The authors declare no competing interests.

References

1. Rands, M. R. W. *et al.* Biodiversity Conservation: Challenges Beyond 2010. *Science*

- 504 **329**, 1298–1303 (2010).
- 505 2. Hoffmann, M. *et al.* The impact of conservation on the status of the world’s vertebrates.
506 *Science* **330**, 1503–1509 (2010).
- 507 3. Tittensor, D. P. *et al.* A mid-term analysis of progress toward international biodiversity
508 targets. *Science* **346**, 241–244 (2014).
- 509 4. Büscher, B. *et al.* Half-Earth or Whole Earth? Radical ideas for conservation, and their
510 implications. *Oryx* **51**, 407–410 (2017).
- 511 5. Noss, R. F. *et al.* Bolder thinking for conservation. *Conserv. Biol.* **26**, 1–4 (2012).
- 512 6. Kareiva, P. & Marvier, M. What Is Conservation Science? *BioScience* **62**, 962–969
513 (2012).
- 514 7. Soulé, M. The ‘New Conservation’. *Conserv. Biol.* **27**, 895–897 (2013).
- 515 8. Wilson, E. O. *Half-earth: our planet’s fight for life*. (Liveright, 2016).
- 516 9. Dinerstein, E. *et al.* An Ecoregion-Based Approach to Protecting Half the Terrestrial
517 Realm. *BioScience* **67**, 534–545 (2017).
- 518 10. Marvier, M. New Conservation Is True Conservation. *Conserv. Biol.* **28**, 1–3 (2014).
- 519 11. Hulme, D. & Murphree, M. Communities, Wildlife and the ‘New Conservation’ in
520 Africa. *J. Int. Dev.* **11**, 277–285 (1999).
- 521 12. Noss, R., Nash, R., Paquet, P. & Soulé, M. Humanity’s Domination of Nature is Part of
522 the Problem: A Response to Kareiva and Marvier. *BioScience* **63**, 241–242 (2013).
- 523 13. Doak, D. F., Bakker, V. J., Goldstein, B. E. & Hale, B. What is the future of
524 conservation? *Trends Ecol. Evol.* **29**, 77–81 (2014).
- 525 14. Miller, T. R., Minter, B. A. & Malan, L.-C. The new conservation debate: The view
526 from practical ethics. *Biol. Conserv.* **144**, 948–957 (2011).
- 527 15. Meine, C. What’s So New about the ‘New Conservation’? in *Keeping the Wild: Against*
528 *the Domestication of Earth* (ed. Wuerthner, G. E. C. T. B.) 45–54 (Island Press,

- 529 Washington, DC, 2014).
- 530 16. Mace, G. M. Whose conservation? *Science* **345**, 1558–1560 (2014).
- 531 17. Minter, B. A. Anthropocentrism. in *Encyclopedia of Environmental Ethics and*
532 *Philosophy* (eds. Baird Callicott, J. & Frodeman, R.) 58–62 (Macmillan Reference USA,
533 2008).
- 534 18. Silvertown, J. Have Ecosystem Services Been Oversold? *Trends Ecol. Evol.* **30**, 641–
535 648 (2015).
- 536 19. Adams, W. M. The value of valuing nature. *Science* **346**, 549–551 (2014).
- 537 20. Adams, W. M. *et al.* Biodiversity conservation and the eradication of poverty. *Science*
538 **306**, 1146–1149 (2004).
- 539 21. Holmes, G., Sandbrook, C. & Fisher, J. A. Understanding conservationists’ perspectives
540 on the new-conservation debate. *Conserv. Biol.* **31**, 353–363 (2017).
- 541 22. Matulis, B. S. & Moyer, J. R. Beyond inclusive conservation: the value of pluralism, the
542 need for agonism, and the case for social instrumentalism. *Conserv Lett* **10**, 279–287
543 (2017).
- 544 23. Tallis, H. & Lubchenco, J. Working together: A call for inclusive conservation. *Nature*
545 **515**, 27–28 (2014).
- 546 24. Gavin, M. *et al.* Effective Biodiversity Conservation Requires Dynamic, Pluralistic,
547 Partnership-Based Approaches. *Sustain. Sci. Pract. Policy* **10**, 1846 (2018).
- 548 25. Hunter, M. L., Redford, K. H. & Lindenmayer, D. B. The Complementary Niches of
549 Anthropocentric and Biocentric Conservationists. *Conserv. Biol.* **28**, 641–645 (2014).
- 550 26. Lute, M. L., Carter, N. H., López-Bao, J. V. & Linnell, J. D. C. Conservation
551 professionals agree on challenges to coexisting with large carnivores but not on
552 solutions. *Biol. Conserv.* **218**, 223–232 (2018).
- 553 27. McShane, T. O. *et al.* Hard choices: Making trade-offs between biodiversity

- 554 conservation and human well-being. *Biol. Conserv.* **144**, 966–972 (2011).
- 555 28. Locke, H. Nature Needs (at least) Half: A Necessary New Agenda for Protected Areas.
556 in *Protecting the Wild: Parks and Wilderness, the Foundation for Conservation* (eds.
557 Wuerthner, G., Crist, E. & Butler, T.) 3–15 (Island Press/Center for Resource
558 Economics, 2015).
- 559 29. Agrawal, A. & Redford, K. Conservation and Displacement: An Overview. *Conserv.*
560 *Soc.* **7**, 1 (2009).
- 561 30. Locke, H. & Dearden, P. Rethinking protected area categories and the new paradigm.
562 *Environ. Conserv.* **32**, 1–10 (2005).
- 563 31. Kidner, D. W. The Conceptual Assassination of Wilderness. in *Keeping the Wild:*
564 *Against the Domestication of Earth* (ed. Wuerthner, G. E. C. T. B.) 10–16 (Island Press,
565 2014).
- 566 32. Samejima, F. *Estimation of Latent Ability Using a Response Pattern of Graded Scores.*
567 (Psychometric Society, 1969).
- 568 33. James, S. P. *Environmental Philosophy: An Introduction.* (John Wiley & Sons, 2015).
- 569 34. Callicott, B. J. *In Defense of the Land Ethic: Essays in Environmental Philosophy.*
570 (SUNY Press, 1989).
- 571 35. Kirby, K. R. ‘New Conservation’ as a Moral Imperative. *Conserv. Biol.* **28**, 639–640
572 (2014).
- 573 36. Batavia, C. & Nelson, M. P. Heroes or thieves? The ethical grounds for lingering
574 concerns about new conservation. *Journal of Environmental Studies and Sciences* **7**,
575 394–402 (2017).
- 576 37. Wuerthner, G. *Keeping the Wild: Against the Domestication of Earth.* (Island Press,
577 2014).
- 578 38. Büscher, B., Sullivan, S., Neves, K., Igoe, J. & Brockington, D. Towards a Synthesized

579 Critique of Neoliberal Biodiversity Conservation. *Capital. Nat. Social.* **23**, 4–30 (2012).

580 39. Christov-Moore, L. *et al.* Empathy: gender effects in brain and behavior. *Neurosci.*

581 *Biobehav. Rev.* **46 Pt 4**, 604–627 (2014).

582 40. West, P., Igoe, J. & Brockington, D. Parks and Peoples: The Social Impact of Protected

583 Areas. (2006). doi:10.1146/annurev.anthro.35.081705.123308

584 41. Adams, W. *Against Extinction: The Story of Conservation*. (Routledge, 2013).

585 42. Holmes, G. Biodiversity for billionaires: capitalism, conservation and the role of

586 philanthropy in saving/selling nature. *Dev. Change* **43**, 185–203 (2012).

587 43. Blanchard, L., Sandbrook, C. G., Fisher, J. A. & Vira, B. Investigating consistency of a

588 pro-market perspective amongst conservationists. *Conserv. Soc.* **14**, 112 (2016).

589 44. Lindsey, P. A., Roulet, P. A. & Romañach, S. S. Economic and conservation

590 significance of the trophy hunting industry in sub-Saharan Africa. *Biol. Conserv.* **134**,

591 455–469 (2007).

592 45. Garland, E. The Elephant in the Room: Confronting the Colonial Character of Wildlife

593 Conservation in Africa. *Afr. Stud. Rev.* **51**, 51–74 (2008).

594 46. Gaston, K. J. Global patterns in biodiversity. *Nature* **405**, 220–227 (2000).

595 47. Miller, B., Soulé, M. E. & Terborgh, J. ‘New conservation’ or surrender to

596 development? *Anim. Conserv.* **17**, 509–515 (2014).

597 48. Marvier, M. A call for ecumenical conservation. *Anim. Conserv.* **17**, 518–519 (2014).

598 49. Green, S. J. *et al.* Conservation Needs Diverse Values, Approaches, and Practitioners.

599 *Conserv. Lett.* **8**, 385–387 (2015).

600 50. Gould, R. K., Phukan, I., Mendoza, M. E., Ardoin, N. M. & Panikkar, B. Seizing

601 opportunities to diversify conservation. *Conserv. Lett.* **15**, e12431 (2018).

602 51. Watts, S. & Stenner, P. *Doing Q Methodological Research: Theory, Method &*

603 *Interpretation*. (SAGE, 2012).

- 604 52. Manfredo, M. J., Teel, T. L. & Dietsch, A. M. Implications of human value shift and
605 persistence for biodiversity conservation. *Conserv. Biol.* **30**, 287–296 (2016).
- 606 53. R Core Team. *R: A Language and Environment for Statistical Computing*. (R
607 Foundation for Statistical Computing, 2018).
- 608 54. Reckase, M. D. *Multidimensional Item Response Theory*: (Springer New York, 2009).
- 609 55. de Boeck, P. & Wilson, M. *Explanatory Item Response Models: A Generalized Linear
610 and Nonlinear Approach*. (Springer Science & Business Media, 2013).
- 611 56. Gorsuch, R. L. Exploratory factor analysis: its role in item analysis. *J. Pers. Assess.* **68**,
612 532–560 (1997).
- 613 57. Velicer, W. F. Determining the number of components from the matrix of partial
614 correlations. *Psychometrika* **41**, 321–327 (1976).
- 615 58. Chalmers, R. mirt: A Multidimensional Item Response Theory Package for the R
616 Environment. *Journal of Statistical Software, Articles* **48**, 1–29 (2012).
- 617 59. Chalmers, R. P. Extended Mixed-Effects Item Response Models With the MH-RM
618 Algorithm. *Journal of Educational Measurement* **52**, 200–222 (2015).
- 619 60. Furr, M. *Scale Construction and Psychometrics for Social and Personality Psychology*.
620 (SAGE Publications Ltd, 2011).
- 621 61. Maydeu-Olivares, A. Goodness-of-Fit Assessment of Item Response Theory Models.
622 *Measurement* **11**, 71–101 (2013).
- 623 62. Thissen, D., Pommerich, M., Billeaud, K. & Williams, V. S. L. Item Response Theory
624 for Scores on Tests Including Polytomous Items with Ordered Responses. *Appl. Psychol.*
625 *Meas.* **19**, 39–49 (1995).
- 626 63. Cai, L. & Hansen, M. Limited-information goodness-of-fit testing of hierarchical item
627 factor models. *Br. J. Math. Stat. Psychol.* **66**, 245–276 (2013).
- 628 64. Hu, L. & Bentler, P. M. Cutoff criteria for fit indexes in covariance structure analysis:

- 629 Conventional criteria versus new alternatives. *Struct. Equ. Modeling* **6**, 1–55 (1999).
- 630 65. Maydeu-Olivares, A. & Liu, Y. Item diagnostics in multivariate discrete data. *Psychol.*
631 *Methods* **20**, 276–292 (2015).
- 632 66. Embretson, S. E. & Reise, S. P. *Item Response Theory for Psychologists*. (Lawrence
633 Erlbaum Associates, 2000).
- 634 67. Everitt, B. S., Landau, S., Leese, M. & Stahl, D. *Cluster Analysis*. (Wiley, 2011).
- 635 68. Scrucca, L., Fop, M., Murphy, T. B. & Raftery, A. E. mclust 5: Clustering,
636 Classification and Density Estimation Using Gaussian Finite Mixture Models. *R J.* **8**,
637 289–317 (2016).
- 638 69. Biernacki, C., Celeux, G. & Govaert, G. Assessing a mixture model for clustering with
639 the integrated completed likelihood. *IEEE Trans. Pattern Anal. Mach. Intell.* **22**, 719–
640 725 (2000).

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Figure 1: The views of conservationists on key issues relating to the future of conservation. The distribution of responses is shown for each survey item. The items are presented from top to bottom according to the arithmetic mean of the responses, assuming that categories are equally spaced. Items indicated by bold text loaded strongly onto one of the three dimensions and were therefore retained for subsequent confirmatory analyses carried out on an independent subset of the data. Items which were excluded from further consideration are indicated by grey text.

Figure 2: Conservationists' views form one cluster, not many. Relationships between each pair of dimensions identified in a multidimensional graded response model. Axes display dimension scores. Dotted lines represent the score for each dimension that would be generated if 'neutral' were selected for every survey item (further details in Methods). Percentage figures in the corner of each panel show the proportion of respondents who fall into the relevant quadrant created by the dotted 'neutral' lines. The correlation between respondents' scores (ρ) on each pair of axes is shown above the panels.

Figure 3: Links between personal characteristics and views. Unfilled circles represent the baseline level in each panel against which the effects of other levels are compared. Filled circles show the mean difference from baseline (logits) with error bars representing 95% confidence intervals. Figures in parentheses are the proportion of respondents belonging to each category under the relevant variable. Non-specific responses (e.g. "Not reported" and "Other") are not displayed.